

**REMARKS****Status of this application**

In the Office Action mailed March 23, 2004, claims 1, 3, 6, 9, 10, 12-13 were finally rejected under 35 U.S.C. §102(b) as being anticipated by Hayka et al. Patent 5,688,118 (hereinafter "Hayka"), claims 2-4, 7-8, and 14 were rejected under 35 U.S.C. §103(a) in view of Hayka, and the remaining claims 11, 15-18, and 19-32 were rejected under 35 U.S.C. §103(a) in view of Hayka when considered in view of an article entitled "Virtual Teeth for Endodontics Training and Practice" by Arnold et al.

This response amends independent claims 1 and 19 (and the remaining claims that are dependent thereon) to more clearly set forth applicants' invention. Claim 20 has been cancelled since its limitations were incorporated into claim 19, claim 21 has been canceled as being duplicative of claim 25, and claims 22 - 24 have been amended to properly reflect antecedents in rewritten claim 19.

Reconsideration of the final rejections under Sections §102(b) and §103(a) is requested for the reasons set forth below. This response is being filed within two months of the mailing of the final rejection, and an advisory action is requested.

**The Section 102 and 103 Rejections based On Hayka et al 5,688,118**

All of the claims recite "a haptic interface including a moveable force-feedback stylus" used to simulate dental procedures for training dental students. In the final rejection, the Examiner has asserted that the dental handpiece 52 shown by Hayka is "a force feedback stylus" as claimed, essentially repeating the rejection advanced in the first Office Action.

In this response, independent claims 1 and 19 have been rewritten to more clearly and definitely set forth the manner in which computer-controlled forces are calculated and applied to applicants' force feedback stylus and to thereby more clearly distinguish the present invention from the mechanism employed by Hayka for controlling the speed of the drill carried by the handpiece 52.

The amendment to claims 1 and 19 as now presented should not be construed as a concession by applicants that Hayka in any way describes or suggests the use of force feedback stylus as previously claimed. On page 7 of the outstanding final rejection, the Examiner stated:

*"Applicant emphasizes that Hayka does not disclose a haptic interface device including a force-feedback stylus to which a digital computer applies calculated interaction forces to simulate the feel of a modeled dental tool. However, it is noted by the examiner, that Hayka clearly discloses a force-feedback hand piece 52 to which a digital computer 80 applies calculated interaction forces to simulate the feel of a modeled dental tool (Col. 10, lines 47-59)."*

However, the cited passage at col. 10, lines 47-59 merely describes the manner in which Hayka's data processing unit controls the rate at which compressed air flows to the drill held by the student to control the drill's speed. Hayka further states that "Since the speed of rotation of the drill 54 dictates the sound and hand-feeling associated with its rotation, a sound and hand-feeling simulation of drilling a 'real' tooth, having layers and structures of different hardness is thus formed." The cited passage at col. 6, lines 33-48 of Hayka describes the use of a sensor to detect the position and orientation of a dental handpiece in six degrees of freedom but does not suggest that the handpiece is a force feedback stylus to which calculated forces are applied. The cited passage at col. 8, line 5 also describes various kinds of position sensors, and does not describe a force feedback stylus to which calculated forces are applied.

Contrary to the Examiner's assertion, nothing in these cited passages suggests that the handpiece 52 is, or functions as, a force-feedback stylus. The Hayka dental handpiece 52 is coupled to a position sensor 62 which determines the position of the drill and the Hayka computer compares that measured position with data simulating a real tooth divided into a region 82 of a first hardness (enamel) and a region 84 of lesser hardness (dentin). If the computer determines that the drill is in region 82, it reduces the air flow to the drill so that it runs more slowly than if the drill is positioned in the softer region 84. It is nowhere suggested that the computer calculates or applies interaction forces to a force feedback stylus. The computer only controls drill speed. While it is true that Hayka teaches that "the speed of rotation of the drill dictates the sound and hand feeling associated with its rotation," Hayka does not suggest that this sound and feeling results from the application of calculated, computer-controlled forces to a force feedback stylus as claimed.

However, in order to even more clearly distinguish applicants' invention from the Hayka system, claims 1 and 19 have been amended to expressly state that the dental tool is modeled by data specifying a plurality of feel points on the surface of the tool and that the processor compares the position of these feel points with positions specified by the tooth model data to

calculate and apply computer-controlled interaction forces to a force-feedback stylus that simulates the feel of a dental tool.

Hayka nowhere suggests or discloses that the dental tool be modeled by storing data defining a plurality of feel points that model the surface of the dental tool, or that the processor compares the positions of these feel points to the locations specified by the tooth model data to calculate and apply computer-controlled interaction forces to a force feedback stylus as now set forth in independent claims 1 and 19 as amended.

As noted by the Examiner, Hayka at col. 10, lines 60-67 states that a sensor is used to produce data indicating the position and orientation in space of the drilling end 60 of the drill 64, and the Hayka processor calculates the effect of the drill on the displayed shape of the artificial tooth so that the user can monitor the effect of the drill on the monitor. The passage relied upon by the Examiner does not suggest comparing the position of plural feel points defining the surface of a dental tool model with tooth model position data to calculate and apply computer controlled forces to a force feedback stylus as now claimed.

Independent claims 1 and 19, as now presented, are accordingly believed to clearly and distinctly set forth subject matter neither disclosed nor suggested in the Hayka patent, and allowance of these claims, as well as the remaining dependent claims which are dependent thereon, is accordingly requested.

The remaining comments identify additional limitations set forth in selected dependent claims that further distinguish over the Hayka patent.

Claims 2, 4, 5-8 and 14 specify the simulation of tools other than a drill, including a pick, carver and an amalgam carrier. The Hayka system employs an actual dental drill together with means for varying the flow of compressed gas to the drill to vary its speed of rotation to simulate drilling a real tooth having regions of different hardness when drilling an artificial tooth whose hardness does not vary. It is again submitted that Hayka's variable speed drill is plainly not a force feedback stylus; accordingly, Hayka provides no mechanism whatsoever that would be capable of simulating the feel of a pick, carver or amalgam carrier as claimed. While Hayka's position sensor could be attached to a "chisel, angle former, enamel hatchet, etc." as suggested at column 12, lines 10-40, there is no mechanism disclosed for simulating these tools by applying calculated forces to the handpiece, and the only forces felt by the student would be those created by the direct collision of the actual tool with the artificial tooth.

Claim 9 states that the display provides a stereoscopic three dimensional display of the models of the dental tool and tooth. The passage at column 8, lines 5-6 cited by the Examiner in rejecting claim 9 describes the use of three dimensional sensors, not three-dimensional stereoscopic displays.

Dependent claims 24-32 describe numerous functions which are implemented through the novel use of feel points and sensor points positioned in various ways relative to locations specified by the tooth model to control the forces applied to the force feedback stylus. None of these specific arrangements are suggested or disclosed in the Hayka patent.

In support the final rejection of claims 24 and 32, the Examiner cites col. 10, lines 60-67 which refers only to the calculation of the effect of the sensed position of the drill bit on the artificial tooth, but does not suggest that calculated forces are applied to a force feedback stylus as claimed.

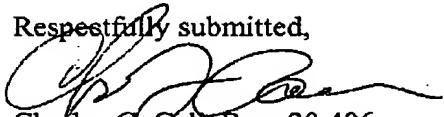
In rejecting claim 25 which states that some of the feel points define the position of the handle, the Examiner cites col. 9, line 10-15 which states only that a position sensor is attached to the handle, but this cited passage does not suggest that feel points that define the position of the handle exist or are used to calculate forces applied to a force feedback stylus.

In rejecting claims 26 and 27 which states that feel points are positioned either outwardly or inwardly from the modification region of the tool to respectively increase or decrease the amount of force the student must apply to the force feedback stylus, the Examiner cites col. 2, line 62 to col. 3, line 12, which describes how the drill speed is varied to simulate the differing hardnesses encountered in a real tooth even though only an artificial tooth is being drilled. This cited passage does not disclose or suggest either the existence or the claimed function of specially positioned feel points.

The Examiner has cited no support in Hayka for his final rejection of claims 30-31 which define the use of sensor points in different configurations to perform specific recited functions.

**Conclusion**

Reconsideration and allowance of claims 1-19 and 22-32 in view of the foregoing amendments and remarks is respectfully requested. An advisory action is requested.

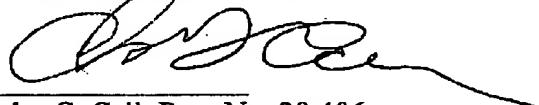
Respectfully submitted,  
  
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Dated: May 24, 2004

**Certificate of Transmission under 37 CFR 1.8**

I hereby certify that this *Amendment* is being transmitted by facsimile to (703) 872-9306 on May 24, 2004.

Dated: May 24, 2004

Signature 

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